Universal Soil Loss Equation (USLE)

The Universal Soil Loss Equation (USLE) was developed in 1954 and used until 1994 in planning for erosion control on cropland. As stated in the National Food Security Act Manual (NFSAM), the USLE factor values in the FOTG as of January 1, 1990 shall be used to determine potential erodibility. The Alternative Conservation Systems (ACSs), developed for landusers who could not reasonably be expected to install Basic Conservation Systems (BCSs, i.e. meet tolerable soil loss limits), are also based on USLE.

The documents that follow reflect the contents of the RI FOTG as of January 1, 1990. They were compiled from two (2) copies of the FOTG, and augmented as needed by materials from the CT FOTG.

When making HEL determinations or reviewing previously-made determinations, refer to Table 4 – Summary of K values, and Table 6 – Length Slope Factors. For complex or irregular slopes, refer also to Agriculture Handbook Number 537, which is archived; the relevant pages are included after Table 6.

The ACSs and planned erosion reductions should be based on the C and P factors in Tables 1-3, 5 & 6. Additional C factors for some specialty crops follow Table 3. If the Conservation Plan is revised, the "before" and currently planned "after" levels of erosion on a field should be recalculated using RUSLE, and the new system should meet the same level of reduction.

Ephemeral gully erosion should also be treated to an equivalent level. The procedure for estimating gross erosion follows the two pages from Ag Handbook 537 on complex slopes.

The final USLE-related document in the 1990 FOTG was on estimating soil loss on construction sites. Each copy of the RI FOTG had a different version of this document, with slightly different information. Since the State of RI produced its *Erosion and Sediment Control Handbook* about that time, with assistance from NRCS, the chapter from the Handbook on estimating soil loss is also included; it combines the information from the other two documents.

TABLE 1B
C FACTORS FOR LONG-TERM ROTATIONS
SILAGE CORN-HIGH MANAGEMENT

$R_1 H_1$	C = .15	R_1CH_1	C = .12	$R_2 H_1$	C = .24
$R_1 H_2$	C = .10	R_1CH_2	C = .08	$R_2 H_2$	C = .18
$R_1 H_3$	C = .07	R_1CH_3	C = .06	$R_2 H_3$	C = .14
$R_1 H_4$	C = .06	R_1CH_4	C = .05	$R_2 H_4$	C = .12
$R_1 H_4$	C = .05	R_1CH_5	C = .04	$R_2 H_5$	C = .10
$R_1 H_6$	C = .04	R_1CH_6	C = .04	$R_2 H_6$	C = .09
$R_1 H_7$	C = .04	R_1CH_7	C = .03	$R_2 H_7$	C = .08
$R_1 H_8$	C = .04	R_1CH_8	C = .03	$R_2 H_8$	C = .07
$R_1 H_9$	C = .03	R_1CH_9	C = .03	$R_2 H_9$	C = .07
$R_1 H_{10}$	C = .03	R_1CH_{10}	C = .02	$R_2 H_{10}$	C = .06

R_2CH_1	C = .18	$R_3 H_1$	C = .29	R_3CH_1	C = .22
R_2CH_2	C = .13	$R_3 H_2$	C = .23	R_3CH_2	C = .18
R_2CH_3	C = .11	$R_3 H_3$	C = .20	R_3CH_3	C = .15
R_2CH_4	C = .09	$R_3 H_4$	C = .17	R_3CH_4	C = .13
R_2CH_5	C = .08	$R_3 H_5$	C = .15	R_3CH_5	C = .11
R_2CH_6	C = .07	$R_3 H_6$	C = .13	R_3CH_6	C = .10
R_2CH_7	C = .06	$R_3 H_7$	C = .12	R_3CH_7	C = .09
R_2CH_8	C = .06	$R_3 H_8$	C = .11	R_3CH_8	C = .08
R_2CH_9	C = .05	$R_3 H_9$	C = .10	R_3CH_9	C = .08
R_2CH_{10}	C = .05	$R_3 H_{10}$	C = .09	R_3CH_{10}	C = .07

CT-RI I-C-3AA
March 1987

Universal Soil Loss Equation (USLE)

List of Documents
Equivalent to 1/1/90 RIFOTG

Title/description	**Identifying feature**	**Date**
Introduction, equation, examples	CT-RI I-C-1 & 2	March 1987
Cropland C-Factors	Table 1	April 1983
C-Factors for Silage Corn	Table 1A	February 1983
C Factors for long-term rotations	Table 1B	March 1987
C Factors for pasture	Table 3	July 1980
Additional C-Factors	compiled	September 2004
A horizon K and T values - RI	Table 4	January 1982
P Factor (*use only for plans prior to 9/89*)	Table 5	January 1982
Support Practice Factor (P)	Tables 5A-5F	September 1989
Determining P Factors for Terraces	CT-RI I-C-6a-6c	October 1981
Slope-Effect Table (LS)	Table 6	July 1980
Adjusting LS for complex slopes	Ag Handbook 537, pp. 15 & 16	1978
SCS Procedure for estimating gross erosion	(2 pages)	
Estimating rainfall-erosion soil losses on construction sites	CT I-C-9-19	September 1976
Estimating rainfall-erosion soil losses on construction sites (RI soils)	Appendix B, I-C-9-24	
Estimating Rainfall-Erosion Soil Losses	Chapter Seven; 7-1 – 7-9	(RI E&S Handbook)

U.S. DEPARTMENT OF AGRICULTURE
Soil Conservation Service
Storrs, Connecticut

TECHNICAL GUIDE -- CONNECTICUT AND RHODE ISLAND

SECTION I-C

PREDICTING RAINFALL EROSION LOSSES

The method described in this section is the Universal Soil Loss Equation. It is used to predict soil loss from sheet and rill erosion. The rate of sheet and rill erosion depends on serveral factors as follow: (1) rainfall energy and intensity, (2) soil erodibility, (3) slope gradient and length of slope, (4) surface conditions such as grass, woodland, farm crops or no cover, and (5) condition of the soil surface and management practice used. These factors may be assigned quantitative values to be used in estimating soil loss. However, the method does not account for soil loss by gully erosion.

The equation is : $A = RK(LS)CP$

A - the computed soil loss expressed in tons per acre per year.

R - the rainfall and runoff factor is the number of rainfall erosion index units in a normal year's rain. The average annual erosive rainfall factor (R value) for Connecticut and Rhode Island is 150.

K - the soil erodibility factor is the soil loss rate per erosion index unit for a specific soil

L - the slope length factor is the ratio of soil loss from the field slope length to a 72.6 foot length, under identical conditions.

S - the slope steepness factor is the ratio of soil loss from the field slope gradient to that from a 9 percent slope under identical conditions.

C - the cover and management factor is the ratio of soil loss from an area with specified cover and management to that from an identical area in a tilled fallow condition.

P - the support practice factor is the ratio of soil loss with a certain conservation practice to that of straight row farming up and down slope.

Soil-loss tolerance (T) sometimes called "permissable soil loss" is given in Table 4 and Section II-D.

Section 11-D contains erodibility (K) values and textures of the A, B, and C soil layers for the Connecticut or Rhode Island Soil series. Values for B or C layers are generally used in determining soil loss on construction sites because these layers are left exposed when the site is disturbed. The values for the A layers are used when the soil is in a more natural state. "K" values for the A layer are summarized in Section I-C-5.

The soil layers are defined as follows:

1. Subsurface Soil -- The layer is generally dark in color and is 0-10 inches thick.

2. Subsoil -- It is below th surface layer and is 10-26 inches thick.

3. Substratum -- It is below the subsoil layer and is 26-60 inches thick.

Examples of How the Universal Soil Loss Equation is Used

This method may be used for calculation of average annual soil loss in tons per acre:

Example - soil: Paxton fine sandy loam
slope: 200' long at 4%
crop: continuous corn, conventional till, no cover, no practices, April planting date

All tables are in Section I-C

R = 150 constant for Connecticut and Rhode Island
K = 0.24 Table 4
C = 0.50 Table 1A
P = 1.0 Table 5

LS Factor = 0.53 Table 6
A = 150 x 0.24 x 0.53 x 1.0 x 0.50 = 9.5 tons/acre/year

Change to conservation tillage alternative, 4,000# residues from winter rye
C = 0.12

A = 150 x .24 x 0.53 x 1.0 x 0.12 = 2.3 tons/acre/year
T = 3 tons/acre therefore, conservation tillage alternative adequately protects the soil resource

CROPLAND C-FACTORS

TABLE 1

Crop	C-Factor
Silage Corn, See Table 1A	
Grain Corn Cont. No Cover, conventional tillage	.32
Row Crop (R) 1st Year Into Sod Cover	.23
Hay After Row Crop Establishment Year	.06
Hay Successive Years	.004
Sweet Corn Followed By Cold Weather Crop Such as Cabbage (Double Cropped)	.50
Sweet Corn W/Rye Cover Continuous, conventional tillage	.31
Potatoes No Cover	.42
Potatoes W/Rye Cover Continuous	.34
Vegetables Continuous (Tomatoes, Peppers)	.64
Vegetables Continuous W/Rye Cover	.36
Strawberries Mulched	.06
Strawberries Not Mulched	.45
Strawberries Not Mulched, 12 Inch Ridges, 50 Percent Cover	.31
Small Grain Followed by Winter Rye	.09
Small Grain Continuous Fall Seeded	.13
Turf Grass August Seeded	.28
October Seeded	.45
Stripcropping, See Below or Table 1A	

Rotations - Conventional Till - Residues Removed

RR HH	.18	RcRcRc HHH	.15
RcRc HH	.14	RRRR HHHH	.22
RRR HHH	.21	RcRcRcRc HHHH	.16

New C Factor
for Grain corn
C = .15
use-.20

TABLE 2

"C" Factors for Woodla

Tree Canopy and Undergrowth Percent of Area 1/	Percent of Area Covered by 1/2" Duff	"C" Factor
100-75	100-90	.0001-.001
70-45	85-75	.002 -.004
40-20	70-40	.003 -.009

1/ When tree canopy is less than 20 percent, or litter cover less than 40 percent, the area will be considered as pasture or idleland for determining C values, see table 3.

CROPLAND C-FACTORS
TABLE 1A
SILAGE CORN-HIGH MANAGEMENT

PLANTING DATE CORN	PLANTING DATE *WINTER COVER	TILLAGE METHOD	C-FACTOR
April	None	Conventional - No Cover	.50
April	Late August 4,000# Residue	Corn Conventional - Cover Lightly Disc	.27
April	Mid September 3,000# Residue	Corn Conventional - Cover Lightly Disc	.33
April	Mid October 2,000# Residue	Corn Conventional - Cover Lightly Disc	.42
April	None	No-Till Corn - No Cover	.47
April	Late August 4,000# Residue	No-Till Corn - Cover Lightly Disc	.12
April	Mid September 3,000# Residue	No-Till Corn - Cover Lightly Disc	.19
April	Mid October 2,000# Residue	No-Till Corn - Cover Lightly Disc	.30
May	None	Conventional - No Cover	.46
May	Mid September 3,000# Residue	Corn Conventional - Cover Lightly Disc	.28
May	Mid October 2,000# Residue	Corn Conventional - Cover Lightly Disc	.36
May	Late October 1,500# Residue	Corn Conventional - Cover Lightly Disc	.42
May	None	No-Till - No Cover	.44
May	Mid September 3,000# Residue	No-Till Corn - Cover Lightly Disc	.14
May	Mid October 2,000# Residue	No-Till Corn - Cover Lightly Disc	.23
May	Late October 1,500# Residue	No-Till Corn - Cover Lightly Disc	.28

* If seed for winter cover is broadcast only, add .01 to C-Value.
If seed for winter cover is drilled or no-tilled subtract .02 from C-Value.

NOTES:

1. MANURE MANAGEMENT - 15 tons manure applied per acre in the fall and spring tilled, the C-Value may be reduced 15 percent. Twenty tons manure applied per acre in the fall and spring tilled, the C-Value may be reduced 25 percent.
2. RESIDUES - If at spring planting, residues are either greater or less than values shown, the C-Value may be adjusted up or down. Each 1,000 pounds of residue is equal to a C-Value change of .01.
3. STRIPCROPPING - If the field has an equal number of row crop and permanent meadow strips, each of equal width, the stripcropping C-factor is equal to ½ of the appropriate C-factor in Table 1A. Where strips are rotated see Table 1.